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In-Toeing and Out-Toeing in Children

SUMMARY

In-toeing and out-toeing problems are generally physiologic variants that arise from in utero posturing, and that gradually correct spontaneously during the active growing years of the child. Few torsional deformities result in genuine problems. Most residual effects are cosmetic, compounded by the anguish of concerned relatives and friends. Rarely is operative correction warranted. If corrective surgery comes under consideration, it is usually deferred until the patient reaches the age of 10. (*Can Fam Physician* 1987; 33:637–640.)

Key words: torsion, growth, physiology

SOMMAIRE

L'hallux valgus et l'hallux varus sont généralement des variantes physiologiques attribuables à la position intra-utérine et qui se corrigent spontanément au cours des années de croissance active de l'enfance. Rares sont les difformités de torsion qui dégénèrent en problèmes véritables. La plupart des effets résiduels sont de nature esthétique et alimentés par l'anxiété de parents ou d'amis. La correction chirurgicale est rarement recommandée et, dans les cas où elle est considérée, elle est habituellement retardée jusqu'à ce que le patient ait atteint l'âge de dix ans.

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IN-TOEING and out-toeing are generally considered variations of normal growth patterns. Such extremity deviations in a youngster are regarded as a problem by the parents, conveyed to the family doctor as a very serious problem, and usually ignored by the growing child. Not all in-toe/out-toe problems are physiological. The great majority, however, are just that. For the attending physician, the real problem is to recognize those deformities which are likely to resolve with time, and those which are not likely to do so, and to allay the fears of the anxious parents and help them to accept a variation of a normal growth pattern. In the past few decades, for undeserved reasons, in-toeing and out-toeing have reached the level of bona fide disease or illness. These gait patterns must have existed prior to that, but now rate equally with such well-recognized illnesses/diseases as increased lumbar lordosis, dorsal round back, deviated septa and ear-lobe variants. These conditions may be considered quite unimportant unless:

- you are the parent of a child with such a problem;
- you regard such physical abnormalities as unacceptable beyond one standard deviation from the mean; and
- you truly believe in attaining all the possible parameters of the normal body specimen.

In-Toeing

Rotational deformities of the lower extremities are a result of intra-uterine positioning of the developing fetus, particularly during the maturing phases of the last trimester of pregnancy. The most common fetal position (83%)[1] is seen in Figure 1. Note that the knees are at the chin, the hips adducted, the lower legs rotated inwards. Examination of this infant after birth will show the following characteristics.

Hips and thighs

Hips and thighs show increased internal rotation and decreased external rotation at the hips.

Between 18 and 36 months, this child will sit in the "squat-sit" (or "W") position for endless hours of the day. The torque force applied to those rapidly growing femora will propagate the torsional deformity. After 36 months the child still assumes a squat-sit position, but is usually too busy to sit for endless hours. Other than in-toeing and frequent tripping, this youngster has no problem. Management at this age mainly comprises reassurance of the parents. The child should be encouraged to learn a

proper, cross-legged sitting pattern,[2] a difficult achievement for a toddler, but, eventually, part of the nursery-school routine.

If no spontaneous correction follows with growth, the youngster toes-in rather badly by the age of five to six years; knee caps face inwards with gait, tripping over the toes is common, and a note from the teacher, the in-laws, or neighbours, usually describes the clumsy gait (Figure 1a). The youngster also destroys shoes in a peculiar fashion. The shoe top from toe to heel will "creep" medially, and the sole wear will also be entirely medial. By this age a child's attention span is sufficient to master sitting in the "lotus" position (reversing the torque on the femora) for a few hours per day. This has proven effective until the child reaches the age of nine, after which little rotational change is possible. As skeletal maturity approaches, it is still possible to improve the child's appearance. Girls become quickly aware of body image and acquire a very proper habitual gait pattern. The price of the cover-up is a minor bow-legged appearance. For strange reasons the affected males are content to continue with their awkward, rambling gait, but the very youth so affected may be the best athlete in the school. Rarely is operative correction indicated, but it is possible by derotation osteotomy of the femora.[3] One should never lose sight of the fact that these femora are essentially minor variations of normal growth patterns. Operative correction may be reserved for that patient who becomes emotionally devastated by the cosmetic appearance, a not uncommon problem in a teen-ager. The decision to operate is not to be taken lightly, since femoral osteotomies are major surgery and are not without hazard.

One rarely sees residual internal femoral torsion in the adult population. When it does appear, it is usually an incidental finding, unrelated to any degenerative arthritic processes or disability.[4]

Figure 1
The Most Common in Utero Position (vertex presentation)

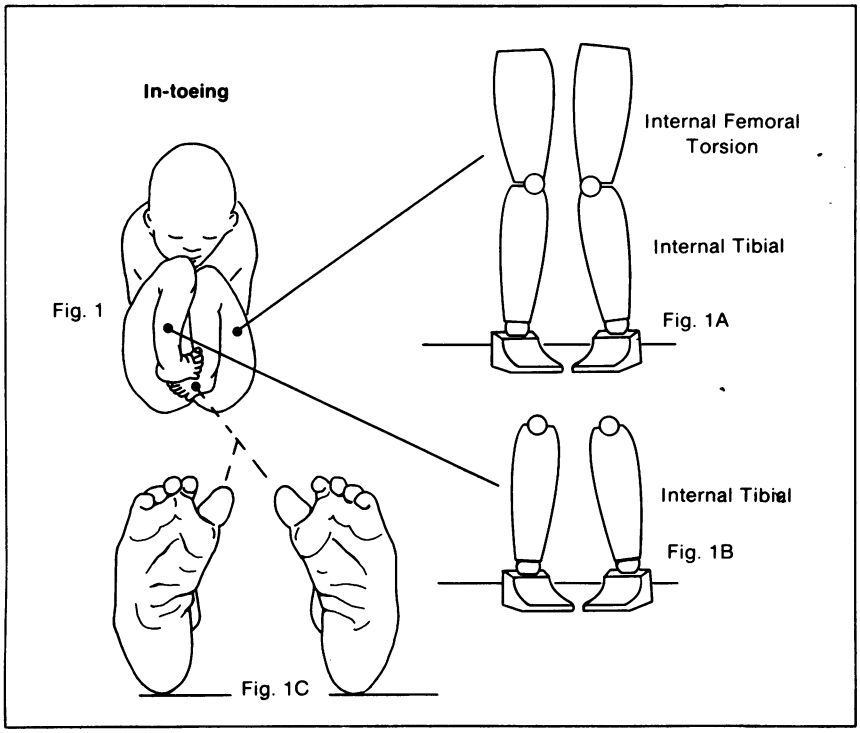


Figure 1a shows the leg position that results from this in utero position. Internal femoral torsion is combined with internal tibial torsion. Figure 1b shows isolated internal tibial torsion, and Figure 1c shows flexible metatarsus adductus.

Figure 2
The Less Common (16%) in Utero Position (vertex presentation)

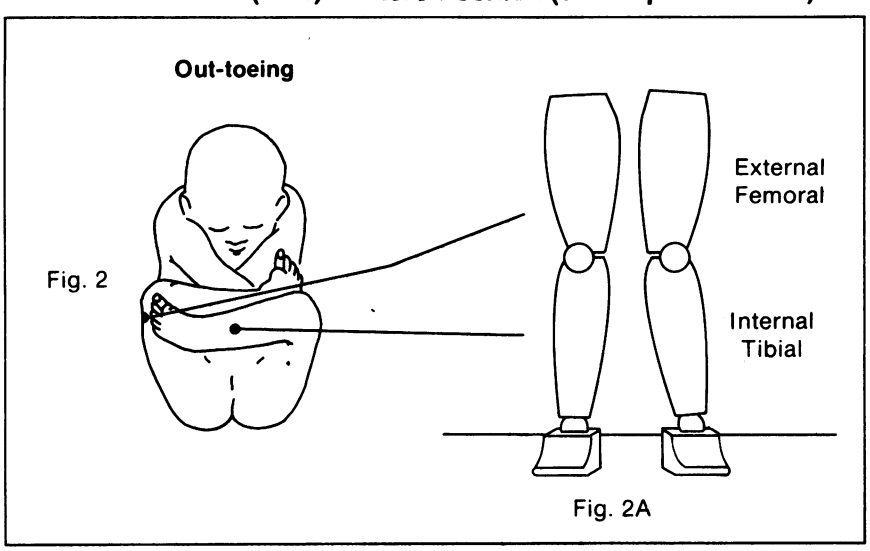


Figure 2a shows external femoral torsion resulting from this in utero position.

Tibiae

The ankle joint axis is turned inwards in relation to the knee joint axis (Figure 1B), producing internal tibial torsion. Easily recognized at birth, tibial torsion tends to correct spontaneously with growth. In most cases it seems to correct so rapidly that residual in-toeing is unapparent when walking commences. In other cases, the correction seems slower, often lasting four to five years. Such torsional deformities continue to correct spontaneously for eight to 10 years.[4, 5]

Because this deformity tends to correct with growth,[3] little more than reassurance of the parents is usually necessary. If such correction is not apparent by 18–30 months, the physician may resort to prescribing Dennis-Browne night splints:[2, 6] shoes attached to a metal bar, the shoe turned

outward 15°–20°. Such splinting is considered most effective prior to the age of two years. However, many infants in this age group are prone to create unmanageable behavioural problems at night, and this is an exhausting experience for anxious young parents. Although correction may not be as rapid, a three-year-old is more co-operative, more understanding, and even reasonable! Such night splints may be worn for intervals of four months until satisfactory improvement is achieved.

Residual in-toeing resulting from internal tibial torsion is noted in approximately 10% of adults. No disability is associated with this gait provided that genu varum (bowing) is not an accompaniment. If such a combination exists, the patient is likely to develop an arthritic medial compartment of the knee in later life.[7]

Feet

The most common posture for the feet, shown in Figure 1, is an in-turned foot, or convex lateral border. This is a normal foot, curved by the constraints of the in utero position. This foot converts readily to normal shape.[3]

Related to this in-turned, infantile, normal foot is the metatarsus varus foot (Figure 1C). This phenomenon, which is also known as a metatarsus adductus foot, is a true deformity, unilateral or bilateral, with variable degrees of severity; it is usually accompanied by internal tibial torsion. The keys to severity are the presence of a well-formed skin crease on the medial side of the foot, and the ease with which the foot can be passively overcorrected. This adducted forefoot is frequently accompanied by adduction or varus of the 1st toe (hallux varus).

Treatment includes corrective shoes: out-flare-last, pre-walker boots. These are usually fitted when the infant is five or six months of age. Shoe fitting at an early age can prove very difficult for the small, chubby foot. Stretching exercises performed by the parents during the infant's first few months will keep the foot supple and easily correctible. If the foot cannot be over-corrected when shoe-fitting age approaches, correction by casting or plastic orthoses (splints) may be indicated. Two or three cast changes (at two-week intervals) are made prior to corrective shoe fitting.[6] The out-flare-last shoes are worn 22 hours a day until the child is 18 months of age. The parents should persist with these shoes for another six months, if any deformity remains. If the foot improves, a change should be made to straight-last shoes until the child is two years old; the child should then wear regular shoes. The hallux varus will tend to remain in spite of a nicely corrected foot.

Other than usual footwear, no specific treatment, particularly operative, is necessary for correction of the first toe. Remember that the child with nicely corrected metatarsus varus feet will still toe in, both because the toes are in an adducted position, and also because the child has not outgrown the internal tibial torsion.[2]

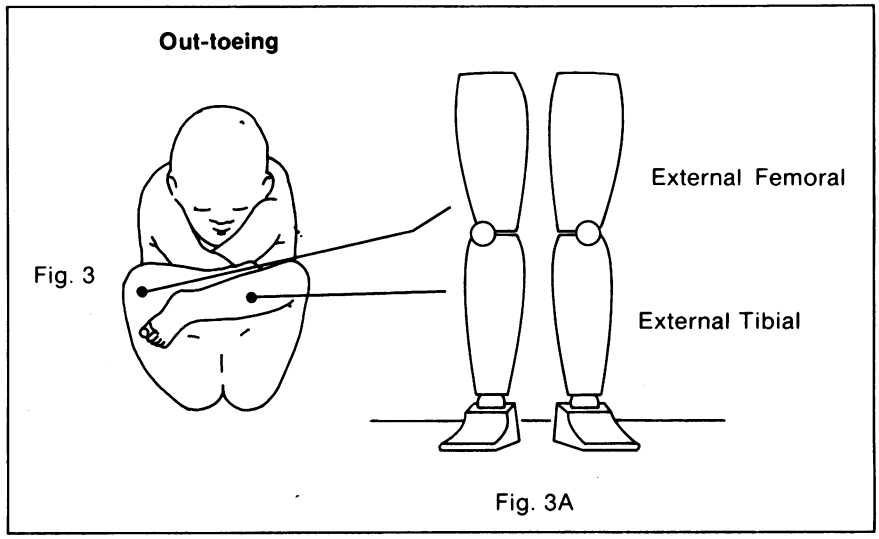
Out-Toeing

Intra-uterine positioning may initiate outward rotational deformities of the lower extremities, though such posture is less common than that resulting in in-toeing.[8] Figure 2 illustrates the in-utero posture in approximately 16% of cases.[1]

Hips and thighs

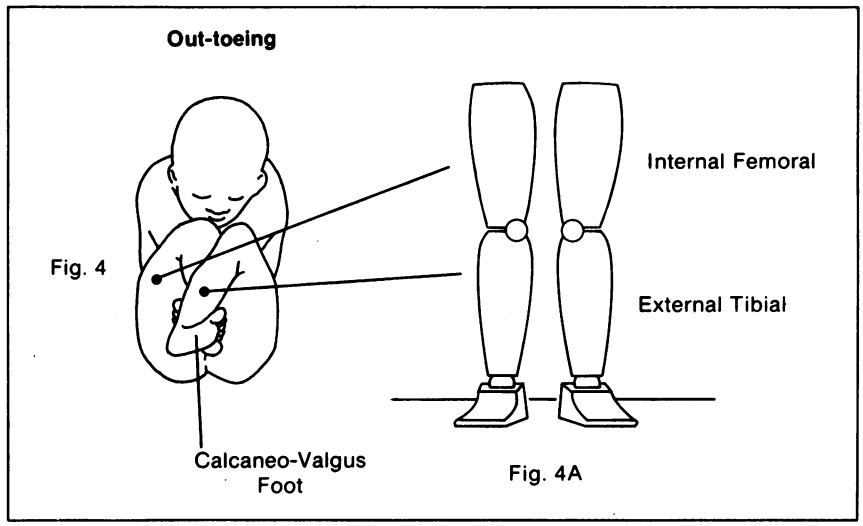
The major effect of the outward rotational in utero posture is on the hips.

Figure 3
Variations of in Utero Leg Positions



These positions produce external femoral torsion and external tibial torsion.

Figure 4
Variations of in Utero Leg-Foot Position



These positions result in internal femoral torsion, external tibial torsion, and calcaneo-valgus foot.

The external rotation is increased and the internal rotation decreased. Although this baby will be a good sitter (with legs crossed in front), it will stand and walk with out-toeing as a result of external femoral torsion. The problems will be:

- a "Charlie Chaplin" gait that will last for a few years, much to the distress of all relatives and friends;
- difficulty forming a medial longitudinal arch on the feet. The take-off phase in gait for these children occurs while the foot is in the stance phase. An orthopedic shoe will not induce an arch in a child's foot. Splints and braces are of no help in these cases. Over time, a foot that lacks a longitudinal arch probably has as many symptoms as a foot with a "good" arch.

External femoral torsion requires parental assurance and reassurance. Eventual, or late, disability is not a permanent result of this condition.

Tibiae

The axis of the ankle joint is rotated outwards relative to the knee-joint axis (Figures 3 and 3A). Fortunately, isolated external tibial torsion is quite uncommon. When this condition is present, the child displays an out-toeing gait and is likely the target for some teasing from his classmates and peers at school. Medically, however, the child has no abnormality, and the parents should be assured of this. Progressive, spontaneous correction can be expected to occur with growth.

On occasion the physician may see external tibial torsion accompanied by internal femoral torsion (Figures 4 and 4A). This condition is not uncommon, and it represents a bad combination only in respect to cosmesis. If this combined rotational deformity is marked, it can only be corrected by surgical intervention, a complex procedure that is rarely indicated.

Feet

Feet are not committed or destined to follow the hip-thigh position. The foot will generally follow the tibial position. Which comes first, the tibial rotation or the torque effect of the foot, is difficult to prove. External rotation of the tibia is often accompanied by a classical foot deformity known as calcaneo-valgus foot (Figure 4)—"calcaneus" because the tip of the heel is the lowest presenting anatomical point; "valgus" because the heel is tipped laterally. More important, however, is the classic finding that the ankle can be dorsiflexed to the extent that the dorsum of the foot easily touches the anterior surface of the tibia. This strange, out-turned foot, moulded by in utero posture, will readily return to a normal plantigrade position within a few months. The message is that any treatment is over-treatment! The only late effect of such a unique infantile foot deformity is the common occurrence of pes planus, a condition which is probably to be expected, considering that all these infants have external tibial torsion! And so, later on, these children may walk with an out-toeing gait derived more from the tibia than the foot.

In sum, most in-toeing/out-toeing problems, with the exception of the occasional stubborn metatarsus varus deformity, are variations of normal growth patterns, deriving from in utero posture, self-limiting and self-correcting through the dynamics of growth. The medical perspective includes understanding the origin of such variations, the recognition of a true deformity, the appreciation of parental concern, the value of simple reassurance, and, most important, the difference between over-treatment and under-treatment. ◉

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